

### **DETAILED ACTION**

This Office Action is in response to the communication filed on 11/10/09. Applicant's arguments have been considered, but are not persuasive. Claims 26-32 and 34-39 are pending. This Action is Non-FINAL.

#### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/10/09 has been entered.

#### ***Claims Analysis***

Claim 26 recites "classified by particle size adjustment to have a mean particle size of 5 to 100  $\mu\text{m}$ ", which appears to be a product-by-process limitation. The process that results in the claimed particle size is not given patentable weight. The claim will be examined as if it recited "graphite material having a mean particle size of 5 to 100  $\mu\text{m}$ ".

Note "obtained by sintering mesocarbon micro-beads" in claim 34 and "is not ground" in claim 39 are product-by-process limitations that are not given patentable weight, in the absence of unexpected results.

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the

Art Unit: 1795

art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 39 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The claim recites "wherein the graphite material is not ground", which does not appear to be supported by the specification as filed. Claim 26 recites "classified by particle size adjustment to have a mean particle size of 5 to 100  $\mu\text{m}$ ". It is unclear how the particle size is "adjusted" if the graphite material is not subjected to some type of grinding process. Examiner notes negative limitations must find proper support in the specification.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 26-32 and 34-39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 26 recites "classified by particle size adjustment", which is indefinite. It is unclear how the particles are "classified" and/or "adjusted".

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 1795

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 26-32 and 34-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacFadden, US 5,772,934 in view of Maruyama et al., US 6,280,878.

MacFadden teaches a lithium polymer battery comprising composite electrolyte-electrode sheets formed on current collectors that are then coated with solid polymer electrolyte (separate solid polymer electrolyte layer) prior to battery assembly (abstract). The SPE is located both internally and at the surface of the electrode structure (3:31-40). One or both of the electrodes of the battery can be further coated with additional SPE to provide an electrical insulator between electrodes of opposite polarity (5:27-40). The battery includes a cathode including a lithium transition metal compound (3:66-4:8), an anode including a carbon material such as graphite (4:9-15) and a solid polymer electrolyte (SPE) including a salt, a polymer and liquid. The electrolyte may include polyacrylonitrile (PAN) as the polymer,  $\text{LiPF}_6$  as the salt and a mixture of ethylene carbonate and propylene carbonate in a ratio of 70:30 to 30:70 as the liquid (5:11-20). The anode and the cathode include a current collector (3:45-48). The polymer is in an amount of 10-20 wt%, the liquid is in an amount of 65-75 wt% and the salt is in an amount of 5-12 wt% based on the SPE total weight (5:21-25). Example 2 has a specific teaching of 14 wt%  $\text{LiPF}_6$  salt, 11 wt% PAN and 75 wt% of ethylene carbonate/propylene carbonate. Other liquids suitable for use as the solvent include

Art Unit: 1795

dimethyl carbonate, diethyl carbonate and  $\gamma$ -butyrolactone (2:21-28). The polymer binder may comprise polyvinylidene fluoride (clm 6).

MacFadden is silent regarding the mean particle size of the graphite material.

However, Maruyama teaches a lithium secondary gel electrolyte battery (title; abstract). The battery includes an electrode comprising a carbon active material. The carbon active material is preferably graphite having a mean particle size of 1 to 30  $\mu\text{m}$ , especially 5 to 25  $\mu\text{m}$ . Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because a smaller mean particle size tends to reduce the charge/discharge cycle life and to increase the variation of capacity. A larger mean particle size would lead to a significantly greater variation of capacity and a lower average capacity. It is believed that a variation of capacity results from a larger mean particle size because the contact of graphite with the collector and the contact between graphite particles become inconsistent (5:9-20). Thus, one of skill would have been motivated to provide the graphite particles of MacFadden with the mean particle size disclosed by Maruyama.

While MacFadden does not explicitly state the number average molecular weight of the PAN, this limitation is considered obvious in view of the teaching by MacFadden that PAN may be used as the polymer of the SPE. Regarding claim 30, Maruyama teaches the concentration of the electrolyte salt (such as  $\text{LiPF}_6$ ) in the electrolytic solution is preferably about 0.1 to 5 mol/liter and that maximum conductivity is generally available at a concentration of about 1 mol/liter (5:34-50). See also Example 1 of

Art Unit: 1795

Maruyama. Claim 34 is a product-by-process limitation that is not given patentable weight.

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Claims 26-32 and 34-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over MacFadden, US 5,772,934 in view of Ozaki et al., US 5,522,127.

MacFadden teaches a lithium polymer battery comprising composite electrolyte-electrode sheets formed on current collectors that are then coated with solid polymer electrolyte (separate solid polymer electrolyte layer) prior to battery assembly (abstract). The SPE is located both internally and at the surface of the electrode structure (3:31-40). One or both of the electrodes of the battery can be further coated with additional SPE to provide an electrical insulator between electrodes of opposite polarity (5:27-40). The battery includes a cathode including a lithium transition metal compound (3:66-4:8), an anode including a carbon material such as graphite (4:9-15) and a solid polymer electrolyte (SPE) including a salt, a polymer and liquid. The electrolyte may include polyacrylonitrile (PAN) as the polymer,  $\text{LiPF}_6$  as the salt and a mixture of ethylene carbonate and propylene carbonate in a ratio of 70:30 to 30:70 as the liquid (5:11-20). The anode and the cathode include a current collector (3:45-48). The polymer is in an amount of 10-20 wt%, the liquid is in an amount of 65-75 wt% and the salt is in an amount of 5-12 wt% based on the SPE total weight (5:21-25). Example 2 has a specific teaching of 14 wt%  $\text{LiPF}_6$  salt, 11 wt% PAN and 75 wt% of ethylene carbonate/propylene carbonate. Other liquids suitable for use as the solvent include

Art Unit: 1795

dimethyl carbonate, diethyl carbonate and  $\gamma$ -butyrolactone (2:21-28). The polymer binder may comprise polyvinylidene fluoride (clm 6).

MacFadden does not explicitly teach the graphite material has a mean particle size of 5 to 100  $\mu\text{m}$ . MacFadden does not explicitly teach the graphite material is obtained from meso-carbon micro beads.

However, Ozaki teaches a non-aqueous electrolyte secondary cell having a negative electrode of carbon material to which intercalation by charging and deintercalation by discharging of lithium is possible (1:8-12). The negative electrode is made from mesophase graphite particles. The mesophase graphite particles are produced from micro beads of mesophase carbon made from pitch (3:1-7). The average particle diameter of the graphite particles is in the range of 3-10  $\mu\text{m}$ , preferably 5-7  $\mu\text{m}$  (6:35-43). A favorable range of the specific surface area of the mesophase graphite particles is 1.0 to 8.0  $\text{m}^2/\text{g}$ , preferably 2.5 to 5.0  $\text{m}^2/\text{g}$  (6:50-58). The negative electrode was fabricated by mixing the mesophase graphite particles with styrene butadiene rubber (binder) to obtain a paste. A copper foil (current collector) of 0.02 mm thickness was coated with the paste of both surfaces. The concentration of  $\text{LiPF}_6$  with respect to the non-aqueous solvent is 1 mol/l ( $\text{mol}/\text{cm}^3$ ) (4:55-58).

Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one of skill would have found it obvious to use the negative electrode of Ozaki for the negative electrode of MacFadden. Ozaki teaches that the negative electrode including mesophase graphite leads to smooth intercalating of lithium at charging over a wide temperature

Art Unit: 1795

range resulting in an increased cell capacity (3:12-14). MacFadden teaches the negative electrode may be a carbonaceous material, preferably graphite, capable of intercalating lithium. Both Ozaki and MacFadden teach nonaqueous secondary cells having a negative electrode including graphite and a nonaqueous electrolyte comprising a lithium salt and a mixed solvent (4:54-58 of Ozaki). One of skill would have been motivated to use the graphite negative electrode of Ozaki as the graphite negative electrode of MacFadden because both materials are capable of intercalating lithium and the graphite negative electrode of Ozaki leads to increased cell capacity.

While MacFadden does not explicitly state the number average molecular weight of the PAN, this limitation is considered obvious in view of the teaching by MacFadden that PAN may be used as the polymer of the SPE.

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Claims 26-32 and 34-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akashi, EP 0724305 in view of Ozaki et al., US 5,522,127.

Akashi teaches a gel electrolyte and a lithium secondary cell using the gel electrolyte. The cell includes a positive electrode which may be a lithium/transition metal composite oxide, a negative electrode which may be a carbonaceous material such as graphite and the gel electrolyte (5:8:16). The non-aqueous solvent and the electrolyte salt used for the production of the gel electrolyte may be those generally used for the production of a lithium secondary cell. The solvent may preferably be ethylene carbonate (EC), propylene carbonate (PC),  $\gamma$ -butyl lactone or mixtures thereof. The preferred salt is  $\text{LiPF}_6$ . A mixture containing EC and PC in combination is preferred

Art Unit: 1795

(4:1-12). The gel electrolyte further includes a polymer having a side chain to which at least one nitrile group is bonded. The polymer is preferably polyacrylonitrile (PAN) and has a number-average molecular weight ranging from about 50,000 to 500,000 (3:45-59). A molar ratio of a monomer as a repeating unit of the PAN to the non-aqueous solvent is suitably in the range of 5:95 to 30:70 though it varies depending upon kinds of the non-aqueous solvent, the gelling agent and the electrolyte salt used. The lithium salt may be in a concentration of 0.4 to 2 M (4:13-17; 31-32). Tables 1 & 2 teach a gel electrolyte including PAN, EC and PC where PC is 10-38 mol% of the gel electrolyte.

Akashi does not specifically teach the negative electrode of claim 26. Akashi teaches lithium secondary cells are well known to have a negative electrode made of a material such as lithium, a lithium alloy or a carbonaceous material capable of occluding lithium (2:12-17). Akashi further teaches examples of suitable negative electrode activating ingredients may include lithium, a lithium alloy and a carbonaceous material capable of occluding lithium, such as graphite (5:12-16).

However, Ozaki teaches a non-aqueous electrolyte secondary cell having a negative electrode of carbon material to which intercalation by charging and deintercalation by discharging of lithium is possible (1:8-12). The negative electrode is made from mesophase graphite particles. The mesophase graphite particles are produced from micro beads of mesophase carbon made from pitch (3:1-7). The average particle diameter of the graphite particles is in the range of 3-10  $\mu\text{m}$ , preferably 5-7  $\mu\text{m}$  (6:35-43). A favorable range of the specific surface area of the mesophase graphite particles is 1.0 to 8.0  $\text{m}^2/\text{g}$ , preferably 2.5 to 5.0  $\text{m}^2/\text{g}$  (5:50-58). The negative



Art Unit: 1795

electrode was fabricated by mixing the mesophase graphite particles with styrene butadiene rubber (binder) to obtain a paste. A copper foil (current collector) of 0.02 mm thickness was coated with the paste of both surfaces.

Therefore, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because one of skill would have found it obvious to use the negative electrode of Ozaki for the negative electrode of Akashi. Ozaki teaches that the negative electrode including mesophase graphite leads to smooth intercalating of lithium at charging over a wide temperature range resulting in an increased cell capacity (3:12-14). Akashi teaches the negative electrode may be a carbonaceous material such as graphite that is capable of occluding lithium (intercalating). Both Ozaki and Akashi teach nonaqueous secondary cells having a negative electrode including graphite and a nonaqueous electrolyte comprising a lithium salt and a mixed solvent (4:54-58 of Ozaki). One of skill would have been motivated to use the graphite negative electrode of Ozaki as the graphite negative electrode of Akashi because both materials are capable of intercalating lithium and the graphite negative electrode of Ozaki leads to increased cell capacity.

Akashi teaches polyvinylidene fluoride is a known electrode binder (page 10, lines 33-34).

### ***Response to Arguments***

Applicant's arguments filed 11/10/09 have been fully considered but they are not persuasive. Applicant argues neither MacFadden nor Ozaki disclose or suggest a graphite material classified by particle size adjustment to have a mean particle size of 5

Art Unit: 1795

to 100  $\mu\text{m}$  (e.g., a material that is not ground). However, "classified by particle size adjustment to have a mean particle size of 5 to 100  $\mu\text{m}$ " is a product-by-process limitation. The process that results in the claimed particle size is not given patentable weight. The claim was examined as if it recited "graphite material having a mean particle size of 5 to 100  $\mu\text{m}$ ". Ozaki teaches the average particle diameter of the graphite particles is in the range of 3-10  $\mu\text{m}$ , preferably 5-7  $\mu\text{m}$  (6:35-43). Furthermore, at least claim 26 does not recite a graphite material that is not ground. Note any evidence of unexpected results must distinguish the claimed invention over the prior art of record. Claim 39 contains a product-by-process limitation and is rejected for containing new matter.

Applicant again argues Ozaki suggests that propylene carbonate is disfavored. This argument has been addressed by the Board of Patent Appeals (and the Examiner) and has been determined to be non-persuasive.

Applicant argues neither Akashi nor Ozaki disclose or suggest a graphite material classified by particle size adjustment to have a mean particle size of 5 to 100  $\mu\text{m}$  (e.g., a material that is not ground). However, "classified by particle size adjustment to have a mean particle size of 5 to 100  $\mu\text{m}$ " is a product-by-process limitation. The process that results in the claimed particle size is not given patentable weight. The claim was examined as if it recited "graphite material having a mean particle size of 5 to 100  $\mu\text{m}$ ". Ozaki teaches the average particle diameter of the graphite particles is in the range of 3-10  $\mu\text{m}$ , preferably 5-7  $\mu\text{m}$  (6:35-43). Furthermore, at least claim 26 does not recite a graphite material that is not ground. Note any evidence of unexpected results

Art Unit: 1795

must distinguish the claimed invention over the prior art of record. Claim 39 contains a product-by-process limitation and is rejected for containing new matter. Akashi teaches the claimed percentage of propylene carbonate in the electrolyte solvent and Ozaki teaches the claimed negative electrode material.

Applicant again argues Ozaki suggests that propylene carbonate is disfavored. This argument has been addressed by the Board of Patent Appeals (and the Examiner) and has been determined to be non-persuasive. Applicant has not addressed the Examiner's motivation for combining MacFadden and Ozaki or Akashi and Ozaki nor has Applicant shown the claimed negative electrode material has unexpected properties over the negative electrode material disclosed by Ozaki. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Examiner points out that the section of Ozaki cited by Applicant as assertedly teaching away from the claimed invention (col. 2, lines 3-6) is part of the background section of Ozaki. Ozaki teaches a non-aqueous electrolyte secondary cell having a negative electrode of carbon material to which intercalation by charging and deintercalation by discharging of lithium is possible (1:8-12). The negative electrode is made from mesophase graphite particles. The mesophase graphite particles are produced from micro beads of mesophase carbon made from pitch (3:1-7). The

Art Unit: 1795

average particle diameter of the graphite particles is in the range of 3-10  $\mu\text{m}$ , preferably 5-7  $\mu\text{m}$  (6:35-43). Thus, Applicant's arguments are not persuasive.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tracy Dove whose telephone number is 571-272-1285. The examiner can normally be reached on Monday & Tuesday (9:00-5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Pat Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

January 11, 2010

/TRACY DOVE/

Primary Examiner, Art Unit 1795